Nest predators of a woodland bird community in south-east Australia

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ABSTRACT

Nest predation is the most common source of nest failure in most passerines, yet the identity of the predators is generally poorly known. Recent advances in surveillance cameras have made the identification of nest predators much easier. We used this technology to investigate the nest predators of a woodland bird community in south-east Australia, for which nest predation averaged 59% per annum over four years. Despite the loss of more than 240 clutches or broods during this period, only one predation event was witnessed prior to the use of cameras, and the identity of predators remained virtually unknown. During the 2012/13 breeding season, cameras recorded 17 acts of nest predation involving seven species of nesting birds, and we identified seven species of predator (four birds and three mammals). For two of the avian predators, we recorded hitherto unknown behaviour.

Key words: *Cacomantis flabelliformis*, camera trap, infra-red camera, nest predator, *Petaurus breviceps, Psophodes olivaceus.*

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Introduction

Avian breeding success is affected by many factors, including food availability, competition for food and nest sites, predation of eggs and chicks, and parasitism by avian and arthropod species (Major *et al.* 1994). Breeding success can also be severely reduced by extreme weather events such as heatwaves and storms (Ricklefs 1969; Guppy *et al.* 2012). For most passerines, nest predation is the prime cause of nest failure, and a powerful influencing force in the selection of breeding strategies and life-history traits (Ricklefs 1969; Nilsson 1986; Martin 1993). The situation is more variable for non-passerines, due mainly to the diversity of habitats in which these birds nest. For example, nest predation of eggs or chicks of the Northern Gannet *Morus bassana* in the United Kingdom is insignificant (Nelson 1978), as it is for the Golden Eagle *Aquila chrysaetos* in Scotland (Watson 1977), and the petrel group as a whole (Warham 1996). But for other taxa, such as the Tundra plovers (Pluvialis spp.), the predation rate can be as high as 78% (Byrkjedal and Thompson 1998), and predation, usually from several species, is the major source of egg mortality in nearly all species of waterfowl (Sargeant and Raveling 1992).

Despite the prevalence of avian nest predation, the identity of the predators involved is generally poorly known; but there are exceptions. For example, the main predator of young Manx Shearwater *Puffinus puffinus* on islands in the eastern North Atlantic is the Great Black-backed Gull *Larus marina* (Brooke 1990), and the major predator of nesting Gould's Petrel *Pterodroma leucoptera* off the east coast of Australia is the Pied Currawong *Strepera graculina* (Priddel and Carlile 1995). But for passerines that live in mixed communities, predators are potentially diverse, and their identity is seldom known (Robinson and Robinson 2001). This is especially so in Australia, where much of our understanding of nest predation is derived from studies targeting single species, predominantly using artificial nests or eggs, but more recently utilising remote cameras. These studies have identified numerous predators of small passerines, including the Grey Currawong *Strepera versicolor*, the Collared Sparrowhawk *Accipiter cirrocephalus*, the House Mouse *Mus musculus*, the Bush Rat *Rattus fuscipes*, the Brown Antechinus *Antechinus stuartii*, the Pied Currawong *Strepera graculina,* the Australian Magpie *Cracticus tibicen*, the Laughing Kookaburra *Dacelo novaeguineae*, the Noisy Minor *Manorina melanocephala*, and unknown species of the Butcherbird, Raven and Possum (Major 1991; Major and Gowing 1994; Major *et al.* 1994; Major *et al.* 1996; Mathews *et al.* 1999; Zanette and Jenkins 2000; Fulton and Ford 2001; Fulton 2006; Colombelli-Negrel and Kleindorfer 2009; Colombelli-Negrel *et al.* 2009).

A previous study of breeding success in a woodland bird community on the south coast of New South Wales found that the annual failure rate of nests over four years was 48–68% (mean 59%; Guppy *et al.* 2012). Most failures were characterized by the disappearance of eggs or chicks, and predation was presumed to be the cause. Although nest predation appeared to be a significant factor in this environment, the predators responsible were elusive. Despite intensive monitoring (two people spent an average of 2–3 hours per day onsite for 6 months of each year) only one act of nest predation was witnessed. This was an Olive-backed Oriole *Oriolus sagittatus* taking young from the nest of a Grey Fantail *Rhipidura albiscapa*, and destroying the nest in the process. To obfuscate the issue further, most nests appeared to be extremely delicate, yet were undamaged during the removal of eggs or chicks, providing neither confirmation that predation had occurred nor any indication of the type of predator responsible.

Because nest predation has such a significant effect on breeding success in this habitat, it is difficult to develop a comprehensive understanding of the breeding ecology without knowing the identity of the predators. Identification is the necessary first step in a process that will eventually comprise more complex analyses of interactions between predators and numbers of breeding pairs, and between predator species, bird species and nest types. The aim of this study therefore, was to identify at least some of the nest predators affecting a suite of woodland passerine birds. The data will enable us (1) to confirm that predation was the cause of extensive egg and chick loss, (2) to determine how many of the predators are feral species, (3) to identify the native predators in terms of class (reptiles vs birds for example) and species, and (4) to explore whether common perceptions of important nest predators are supported by quantitative evidence. The study took advantage of the combination of recent improvements in surveillance camera technology, and a bird community that has been studied in great detail.

Methods

Study site

The study site (35°52'S, 150°03'E) was a 10-ha area (approximately 200 m x 500 m; 100 m above sea level) of freehold land, 6 km northwest of Moruya, New South Wales, Australia. The site was on the west side of a ridge that sloped to a small ephemeral creek. Vegetation comprised a mixture of open woodland (Blackbutt *Eucalyptus pilularis*, Stringybark *E. globoides* and *E. muellerana*, Spotted Gum *E. maculata*, Grey Ironbark *E. paniculata* and Rough-barked Apple *Angophora floribunda*), dense thickets of Burrawang *Macrozamia communisa*, Black She-oak *Allocasuarina littoralis* and Tick Bush *Kunzea ambigua*, and a dense stand of Swamp Paperbark *Melaleuca ericifolia*. A power-line clearing (30 m wide) ran the length of the site, and contained Tick Bush, Bracken *Pteridium esculentum* and open grassland. In addition, there were several small dams containing Cumbungi *Typha orientalis*, Spikerush *Eleocharis* sp. and Reed *Phragmites australis*, and a riparian environment of various shrubs (Water Gum *Tristania laurina*, Grey Myrtle *Backhousia myrifolia*, *Melaleuca* spp., *Callistemon* spp., and River Oak *Casuarina cunninghamiana*) next to a rocky streambed.

Nests monitored

Between 1 August 2012 and 31 January 2013, MG and SG spent an average of 2.9 hours each day searching the study site to find a total of 164 nests. A sample of 52 nests of nine common species was monitored by surveillance cameras. These species were Superb Fairy-wren *Malurus cyaneus* (9 nests), Variegated Fairy-wren *M. lamberti* (1 nest), Brown Thornbill *Acanthiza pusilla* (6 nests), Yellow-faced Honeyeater *Lichenostomus chrysops* (22 nests), New Holland Honeyeater *Phylidonyris novaehollandiae* (2 nests), Eastern Yellow Robin *Eopsaltria australis* (8 nests), Rufous Whistler *Pachycephala rufiventris* (1 nest), Grey Fantail (1 nest), and Silvereye *Zosterops lateralis* (2 nests). The fairy-wrens and Brown Thornbill build dome nests on or near the ground, the other six species build open cup-shaped nests 1–25 m above ground. All species have preferred nesting habitats, which occur throughout the study area. Nests were selected on the basis of whether a camera could be set up within 1.5 m of the nest and was readily accessible at daily intervals. It was difficult to put cameras on nests located 3 m or more above ground, so species that always nest above that height—White-naped Honeyeaters *Melithreptus lunatus*, Yellow Thornbills *Acanthiza nana*, Striated Thornbills *Acanthiza lineata* and Scarlet Honeyeaters *Myzomela sanguinolenta*—were not sampled.

Cameras

The cameras (HC500 Hyperfire Semi-Covert IR; Reconyx Inc, Wisconsin) were digital, with a passive infrared motion detector, and a night time infrared illuminator. They were mounted on a metal stake, or strapped to a tree, and positioned 100–150 cm from nests that were 0–3 m above ground. One camera was placed at each nest and set on high sensitivity to take 10 pictures (1 per second) for each trigger. There was a delay of about 7 seconds between successive triggers. The SD memory cards held approximately 10,000 pictures and the cameras and nests were checked every 1–3 days. The first camera was deployed on 28 August 2012, the last camera was removed at the conclusion of the last known nesting attempt on 2 February 2013.

Results

Of the 52 nests monitored with a camera, 27 (52%) were successful in producing fledged young, and 25 (48%) failed; this compares with a 51% failure rate for nests without cameras during the season. One successful nest lost one egg to predation, but the adults successfully raised the remaining egg. Of the failures, 20 (39% of the 52 nests) were due to predators; the other 5 (10% of the 52 nests) were abandoned. The reasons for abandonment are unknown, but two were probably the result of a two-day heatwave when ambient temperatures reached 45.9°C, accompanied by strong hot winds (see Guppy *et al.* 2012). In one of the other cases the female probably died as she disappeared and was not seen again. None of the abandonments could be linked to the presence of the camera, as activity at each abandoned nest continued in the presence of the camera for at least 3, and up to 23 days before abandonment. Breeding birds seemingly took no notice of the camera and resumed brooding or feeding young within minutes of a camera being deployed.

In all, 17 acts of predation involving seven species of nesting bird were recorded on camera, and seven predators were identified (four birds and three mammals, Table 1). One nest suffered at least two separate acts of predation, and five acts of predation (evidenced by the disappearance of eggs or chicks) were missed by the cameras. Of the predation events captured on camera, 47% were of eggs, and 53% were of young birds. The data suggest that the Eastern Whipbird *Psophodes olivaceus* may take only eggs, the Laughing Kookaburra may take only young, and the Fan-tailed Cuckoo *Cacomantis flabelliformis* takes both eggs and young. Birds predated nests during all hours of the day, and mammals during all hours of the night. These findings should be interpreted cautiously as larger sample sizes are needed to more fully elucidate predator behaviour.

Of the 21 nests that were depredated (including five that were not recorded on camera), only four showed signs of damage: the Brown Thornbill nest attacked by a goshawk (predation # 10, Table 1); the Silvereye nest attacked by a Laughing Kookaburra (predation # 14, Table 1); a Yellow-faced Honeyeater nest for which the predation episode was not recorded, and the Yellow-faced Honeyeater nest attacked by a goshawk (predation # 12, Table 1). The latter nest, which was the subject of three attacks by the same bird over about 15 minutes, was only superficially damaged.

Discussion

This study identified a suite of nest predators that together represent the most significant factor limiting the breeding success of passerines on this site. The findings confirm that most nest failures are due to predation, and reveal (1) some expected predators, (2) the absence of some predicted predators, (3) some unexpected predators, and (4) some interesting and previously unknown behaviour.

Expected predators

Four of the predators could be reasonably predicted for this particular habitat. Goshawks are likely predators, and both the Brown Goshawk and Collared Sparrowhawk are found on the site. Elsewhere, there is one previous record of a Brown Goshawk taking nestlings (Marchant and Higgins 1993), several previous records of the Collared Sparrowhawk taking nestlings (Marchant and Higgins 1993), and a goshawk has been captured on camera, on the ground, attempting to rob the nest of a Superb Fairy-wren (Columbelli-Negrel *et al*. 2009). The Brown Goshawk and Collared Sparrowhawk are difficult to distinguish from surveillance photographs, but one or the other was the predator in three different events (predations # 10–12, Plates 12–16, Table 1) that involved (1) three different prey species, (2) both dome and open nests, and (3) nests at heights of 0–3 m. In one predation event (#10, Table 1), the goshawk left two live young in the nest, despite tearing the top off the nest. We have no explanation for this, but it is not without precedent. In a study of the Superb Fairy-wren, visits by a Pied Currawong and Collared Sparrowhawk were recorded, in which neither the eggs nor the nest were disturbed (Colombelli-Negrel *et al*. 2009).

The Laughing Kookaburra (predations #13 and #14, Table 1) is an obligate carnivore. So predictably, there are numerous records of this species taking nestlings (eight different species including passerines and non-passerines; see references cited in Major *et al*. 1996; Higgins 1999).

Two types of small mammal—a rat *Rattus* sp. and *Antechinus* sp.—were observed to take nestlings (predation # 16–17, Table 1). Although it is known that small mammals prey on eggs and nestlings, observations of actual events in Australia are rare. There are several previous observations of Rattus raiding the nests of small passerines (Major 1991; Major *et al*. 1994, 1996; Major and Gowing 1994; Colombelli-Negrel *et al.* 2009), but we found only two published cases of Antechinus as a nest predator (Major *et al.* 1994; Matthews *et al*. 1999). These latter two studies utilised artificial nests, so as far as we know, the present study provides the first documentation of *Antechinus* predation at natural nests. In this study, predations involving *Rattus* and *Antechinus* left no nestling remains (such as the bill, skull or feet) near the nest, suggesting these predators removed the nestlings from the nest to consume them some distance away. Pictorial evidence from a study on egg predation (Major 1991) showed that Black Rats *Rattus rattus* took eggs away to eat on 50% of occasions.

Absent predator

The Pied Currawong was not recorded as a nest predator in this study. This is surprising as there are numerous observations of Pied Currawongs taking eggs and nestlings (see references cited in Higgins *et al*. 2006), and dedicated studies on this species show them to be significant nest predators of a variety of passerines (Major *et al.* 1996; Fulton and Ford 2001). A pair of currawongs regularly breeds on or near the study site, and did so in the 2012/13 season; adults with young were seen on the site while cameras were deployed.

Unexpected predators

The recorded predation of eggs by a glider *Petaurus* sp. (predation # 15, Plate 18, Table 1) was unexpected. There is some doubt as to the identity of the glider as it is difficult to distinguish, from the photograph, between a Sugar Glider *Petaurus breviceps* and a Squirrel Glider *P. norfolcensis.* The Sugar Glider is common on the site, whereas the Squirrel Glider is relatively rare in the area, so the animal detected is likely to be the former. The size of the animal relative to the size of the egg (Plate 18) also suggests a Sugar Glider. Nest predation by either species has rarely been reported. There is a single published observation of egg predation by a Squirrel Glider (Dobson *et al*. 2005), one by a Sugar Glider (Winter 1966), and one observation of an Owlet-nightjar *Aegotheles cristatus* attacking a Sugar Glider that was near its nest (Doucete 2007). However, recently Sugar Gliders have been found to prey on the nests of the Swift Parrot *Lathamus discolor* (Stojanovic 2013).

The Eastern Whipbird is a significant, catholic, and previously unrecognized nest predator on the site (predation # 1–5, Plates 1–4, Table 1). To our knowledge such behaviour has not been recorded previously for this species. The five events recorded involved (1) three different species, (2) both dome and open nests, and (3) nests ranging in height from 0.2–1.5 m. The predation events were widely separated spatially, and occurred in several different microhabitats including a *Kunzea* thicket next to a dam, dry scrub in the middle of the site, dry scrub on the edge of the power-line clearing, and a dry grassy area. Photographs taken at a successful nest of the Superb Fairy-wren (Plates 19–21) show the breeding pair displaying extreme aggression toward a passing Whipbird. Although wrens may react in this way to any bird that encroaches on the nest site, this directed aggression is consistent with a scenario whereby the Eastern Whipbird is recognized as a potential nest predator.

Previously unknown behaviour: the fan-tailed cuckoo

Of sixteen depredated nests with camera traps, four were raided by a Fan-tailed Cuckoo (predation # 6–9, Table 1). Photographs of these events (Plates 5–11) are the first showing the removal of eggs or nestlings by the Fan-tailed Cuckoo, and may represent farming rather than depredation (see Davies 2000). The data from Predation Event #8 (Table 1) is at least consistent with the concept of farming. In this event, the cuckoo ate the eggs (parasitisation would have been unsuccessful as the Brown Thornbill eggs were due to hatch in 5 days), forcing the Brown Thornbill pair to build another nest. This nest was then successfully parasitised by a (arguably the same) cuckoo.

Interactions between this species and the nests of the Brown Thornbill, White-browed Scrubwren, and Variegated and Superb Fairy-wrens have been documented previously on this site (Marchant 1992), and more widely (see references cited in Higgins *et al.* 2006). Successful parasitism however, has not been common on the study site. Since 2007, only one Fan-tailed Cuckoo egg has been found in a Brown Thornbill nest, and twice (including predation # 8, Table 1) a Brown Thornbill pair raised a young Fan-tailed Cuckoo (Guppy, unpublished data; this study).

The Fan-tailed Cuckoo may not have a significant impact as an avian brood parasite, but there is no doubt it can be an important nest predator, particularly on the Brown Thornbill. The impact on this species is exacerbated by its low propensity to re-nest; during the last five seasons (08/09-12/13) only 21% of 56 breeding pairs re-nested following a failure (there was also one re-nesting after a success) (Guppy, unpublished data). So the destruction of a nest by a Fan-tailed Cuckoo usually renders that breeding season, for that pair, a failure.

In two of the cases of predation by the Fan-tailed Cuckoo (predation # 7 and 9) only one of three young or eggs was removed. Egg removal without laying has been observed for both of the bronze-cuckoo species in Australia—Shining Bronze-Cuckoo *Chalcites lucidus* and Horsfield's Bronze-Cuckoo *C. basalis*—but in both instances the cuckoo returned to lay its own egg (Brooker *et al.* 1988; Brooker and Brooker 1989). The removal of an egg from the nest of the Variegated Fairy-wren may simply have been opportunistic feeding, and the evidence for the removal of the one young from the Brown Thornbill nest (predation #7, Table 1) is circumstantial, as no nestling was seen in the bill of the cuckoo and the nest was subsequently visited by a goshawk. However, the cuckoo definitely put its head into the nest, which was followed by body and wing movements reminiscent of those of the Fan-tailed Cuckoo in predation # 6 (Table 1).

Nest damage

This study has demonstrated that predators can remove an entire clutch of eggs or brood of nestlings without causing any apparent damage to the nest (Plates 3 and 17). Not only are the predators surgical when taking eggs, the nests are more robust (mainly through elasticity) than they appear. The Whipbird and Sugar Glider are capable of delicately removing eggs from the nest, and during depredation, the wings of the Fan-tailed Cuckoo remained outside the dome nests of the Brown Thornbill. The Brown Goshawk in predation # 11 (Table 1) landed on the nest and deformed it substantially, but the nest sprang back to its original position and shape. Even the nest from which nestlings were removed by a Laughing Kookaburra, which had to land on or near the hanging nest amongst fine branches, was undamaged afterwards (Plate 17). Overall, nest damage was unusual; of 21 nests that were depredated (including the five that were not caught on camera) only 4 showed signs of disturbance.

Camera reliability

Five predation events were not captured on camera. We discovered that the cameras tended to shut down in high humidity. This is probably the reason for three of the failures to record predation, as these all occurred either during or after rain. In these cases there were long periods when pictures were absent, and tellingly, no pictures were taken when the observer approached (from the nest side of the camera) to check the camera. In the fourth case the camera was probably too far away. It did trigger, but infrequently, and the predation was probably missed for this reason. These cameras are heat-triggered, the heat source is often small, and the detection is limited by the inverse square law, so the efficacy of the camera is very sensitive to distance. The fifth failure took place at a difficult site. The nest was high, the camera was pointing up, and wind caused branches in the field of view to move constantly. Triggering was unreliable and inconsistent.

Conclusion

This study has advanced considerably our understanding of nest predation in this woodland bird community. We are confident that the predators that have been identified have a significant impact on the breeding success of the birds on this site. These data confirm that the high rate of nest failure is due to nest predation, but this list of predators is certainly not comprehensive and may vary between seasons. The study has also shed light on avian behaviour with relation to predation, and demonstrated the utility of surveillance cameras in studies of this kind.

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APPENDIX I

Table 1. Details of each predation event photographed.

Events are listed in the order of predator frequency, and then for each predator in date order.

#	Predator	Plates	Date Time	Nesting species	Nest contents and fate	Observations	Previous nests for this pair	Subsequent nests
1	Eastern Whipbird	1	17.9.2012 1500	New Holland Honeyeater	One egg taken, one egg/nestling left unharmed which later fledged	One visit, one egg in bill, no eggshell found	None	Possibly one
2	Eastern Whipbird		07.10.2012 1240	New Holland Honeyeater	Two eggs, both taken	One visit, one egg in bill, no eggshell found	One, 20 m away taken at the nestling stage on 24.9.2012 by an unknown predator	None
3	Eastern Whipbird		02.11.2012 0800	Yellow-faced Honeyeater	Two eggs, both taken	One visit, head in nest, no egg seen in bill, no eggshell found	None	One, started 04.11.2012, 10 m away, successful
4	Eastern Whipbird	2–3	12.11.2012 1530	Yellow-faced Honeyeater	Two eggs, both taken	One visit, one egg in bill, broken egg found 2 m from nest	None	One, started 30.11.2012, 20 m away, successful
5	Eastern Whipbird	4	19.11.2012 1120	Superb Fairy-wren	Three eggs, all taken	Two visits (1 hour apart), egg in bill on first visit, no eggshell found	None	One, started 26.11.2012, 40 m away, successful
6	Fan-tailed Cuckoo	5-6	08.10.2012 0940	Brown Thornbill	Three nestlings, all taken, two found alive on ground near nest	One visit, went to nest twice and put head in nest, no nestling seen in bill	None	None
7	Fan-tailed Cuckoo	7-8	08.10.2012 1630	Brown Thornbill	Three nestlings, two unharmed and one found dead on ground	One visit, head in nest, no nestling seen in bill. This nest subsequently visited by a goshawk (see # 10 below)	None	One, started building 29.10.2012 but not completed
8	Fan-tailed Cuckoo	9-10	21.10.2012 1900	Brown Thornbill	Three eggs, all taken	One visit, removed three eggs, swallowed at least one, left with last egg, no eggshell found	None	One, not found (out of study site), pair seen feeding young Fan-tailed Cuckoo 17.12.2012

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9	Fan-tailed Cuckoo	11	06.12.2012 1140	Variegated Fairy-wren	Three eggs, one taken	One visit, removed and left with one egg	None	None, but female continued to incubate remaining two eggs until taken by rat (see # 17 below)
10	*Accipiter* sp. Probably Collared Sparrowhawk	12	09.10.2012 1400	Brown Thornbill	Two nestlings, both unharmed	Accipiter, one visit, seen on ground, then attacked nest with feet, top of nest gone but young survived and continued to be fed by adults	See # 7	See # 7
11	*Accipiter* sp. Probably Brown Goshawk	13	11.10.2012 0620	Eastern Yellow Robin	Two nestlings, both taken	Accipiter, visited twice in 20 mins, put head in nest on second visit, no nestlings seen in bill or feet	None	Three, first started 17.10.2012, none successful
12	*Accipiter* sp.	14-16	23.12.2012 1110	Yellow-faced Honeyeater	Two nestlings and one egg, all taken	Accipiter, three visits in 20 mins, seen taking both nestlings	One, 20 m away, possible fledging on 22.11.2012	One, started 24.12.2012, 25 m away, successful
13	Laughing Kookaburra	17	08.11.2012 1900	Yellow-faced Honeyeater	Two nestlings, both taken	One visit, nothing seen in bill, no sign of nestlings near nest	None	One, started 16.11.2012, 35 m away, successful
14	Laughing Kookaburra		14.12.2012 1000	Silvereye	Two nestlings, both taken, one found dead on ground, nest at an angle	One visit, nothing seen in bill	None	None
15	Sugar Glider	18	04.11.2012 0140	Eastern Yellow Robin	Two eggs, both taken	One visit, one egg seen in mouth, eggshell in and below nest	Two building attempts but no eggs	One, started 06.11.2012, 35 m away, successful
16	*Antechinus*		10.10.2012 2300	Brown Thornbill	Unknown number of nestlings, all taken	Antechinus in and around nest for 3 hours, no nestlings seen in mouth, no nestling parts seen near nest	None	None
17	Rat		18.12.2012 0250	Variegated Fairy-wren	See Predation #9 Two nestlings, both taken	Rat seen at nest for about one minute, no nestlings seen in mouth, no parts of nestlings found in or around nest	None	None

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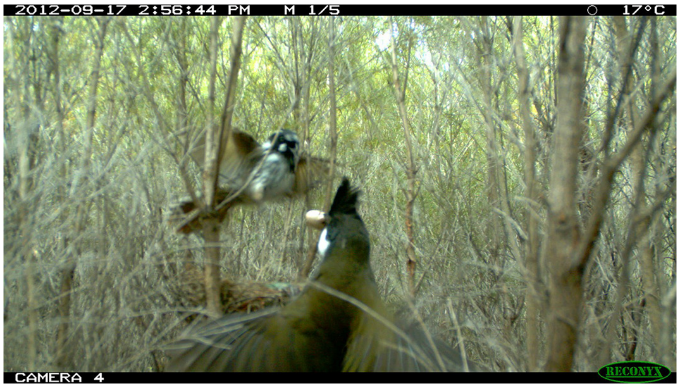

Plate 1. An Eastern Whipbird (below) taking an egg from the nest of a New Holland Honeyeater (above).

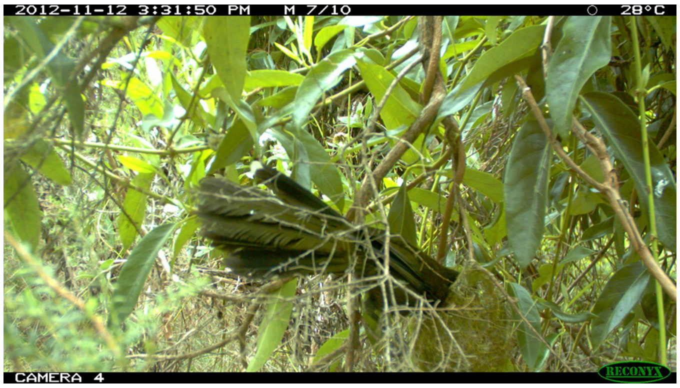

Plate 2. An Eastern Whipbird with its head in the nest of a Yellow-faced Honeyeater, taking an egg.

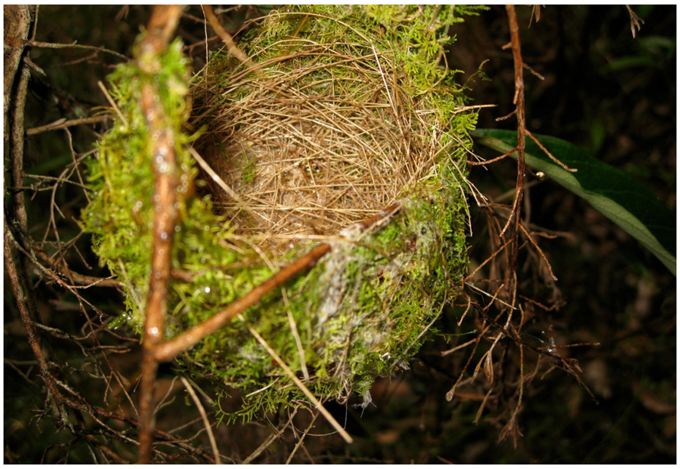

Plate 3. The undamaged nest of a Yellow-faced Honeyeater (see Plate 2) after the Eastern Whipbird removed two eggs.

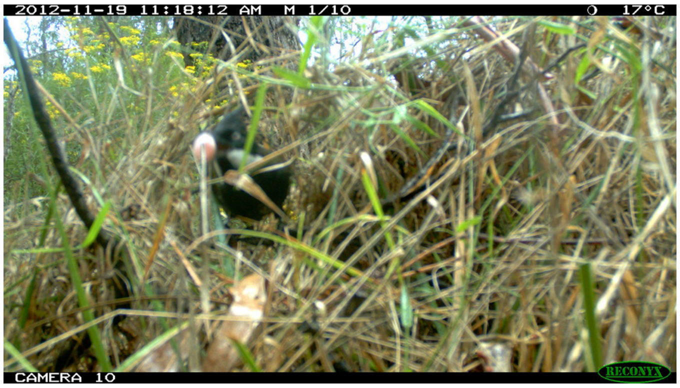

Plate 4. An Eastern Whipbird with an egg taken from a Superb Fairy-wren nest, just visible to the right of the bird.

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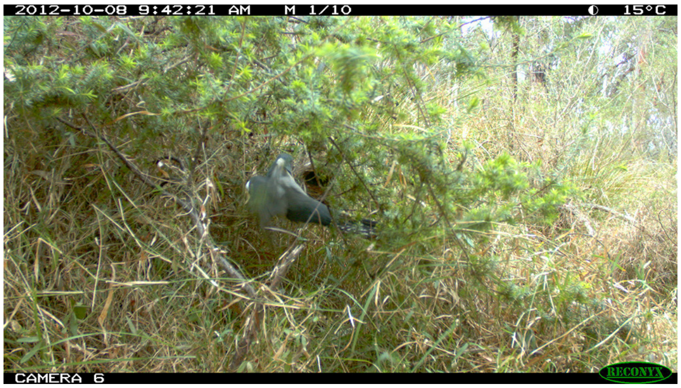

Plate 5. A Fan-tailed Cuckoo arrives at the nest of a Brown Thornbill. The nest entrance is visible to the right of the bird.

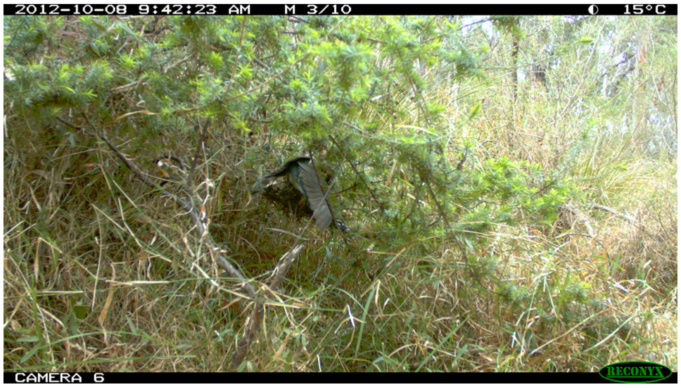

Plate 6. The Cuckoo puts its head into the nest to remove nestlings.

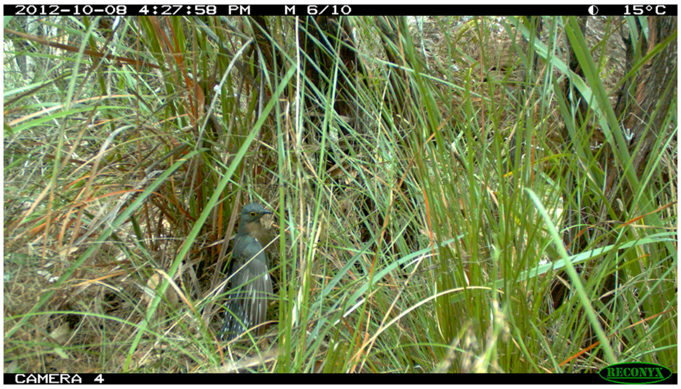

Plate 7. A Fan-tailed Cuckoo arrives at the nest of a Brown Thornbill. The nest is obscured from view, but is slightly below and to the right of the bird.

Plate 8. The Cuckoo puts its head into the nest to remove a nestling.

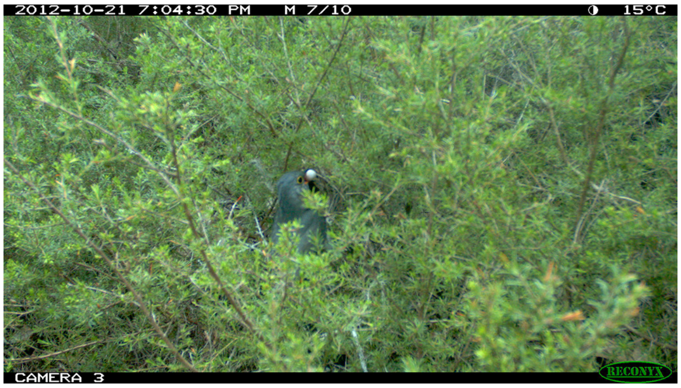

Plate 9. The Cuckoo pulls an egg out of the nest

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Plate 10. Two seconds later, the Cuckoo swallows the egg.

Plate 11. The Cuckoo reappears, after visiting the nest, with an egg in its bill.

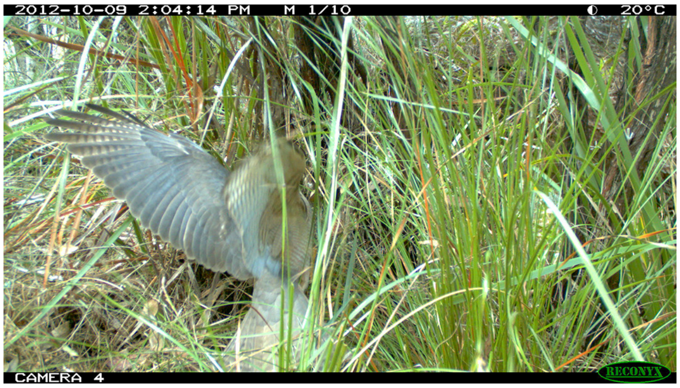

Plate 12. A goshawk attacks the nest feet first.

Plate 13. A goshawk stands on the nest of an Eastern Yellow Robin, and reaches into the nest with its bill. The weight of the bird distorts and tilts the nest, but it returns to its original shape after the bird leaves.

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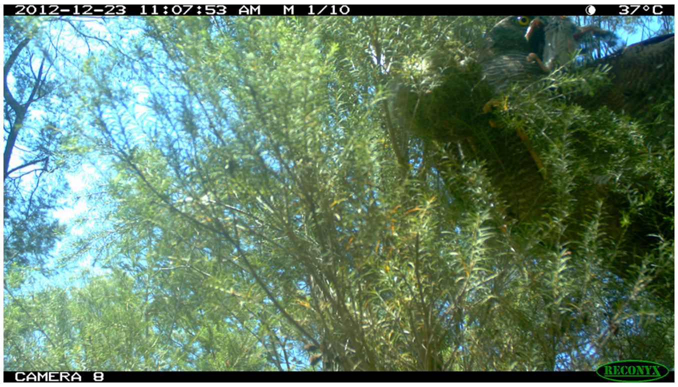

Plate 14. A goshawk takes a nestling out of the nest of a Yellow-faced Honeyeater. The nest is to the left of the bird, and the body, wing and leg of the nestling are to the right.

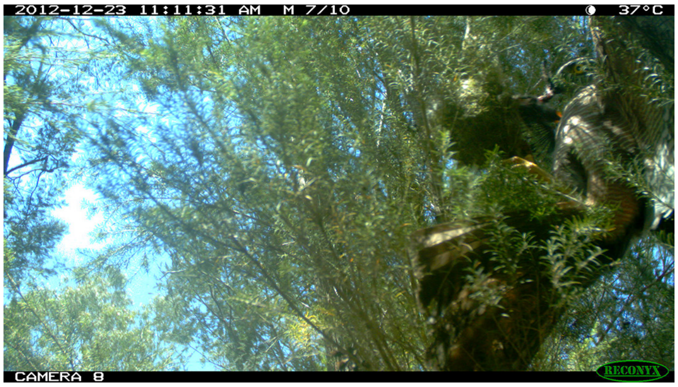

Plate 15. Three and a half minutes later, the goshawk returns and takes another nestling. The nestling is visible in the bill.

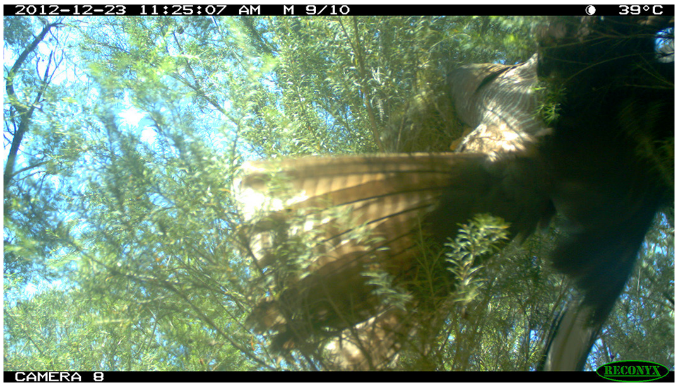

Plate 16. Fourteen minutes later, the goshawk returns, puts its head inside the nest, and presumably removes the egg.

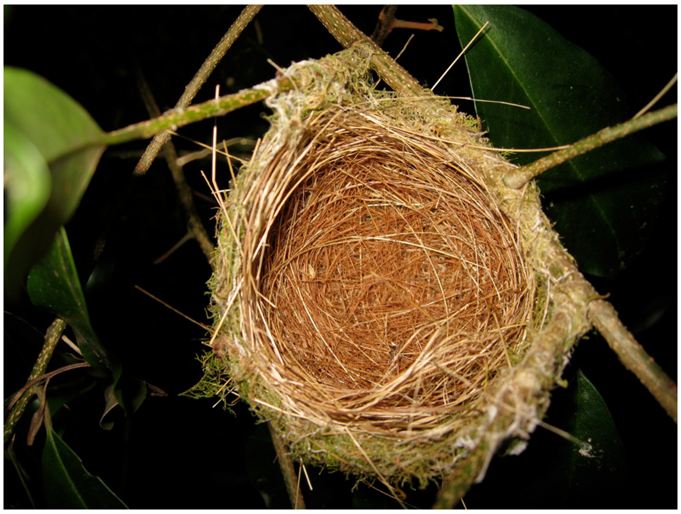

Plate 17. The undamaged nest of a Yellow-faced Honeyeater after a Laughing Kookaburra landed nearby and removed two nestlings.

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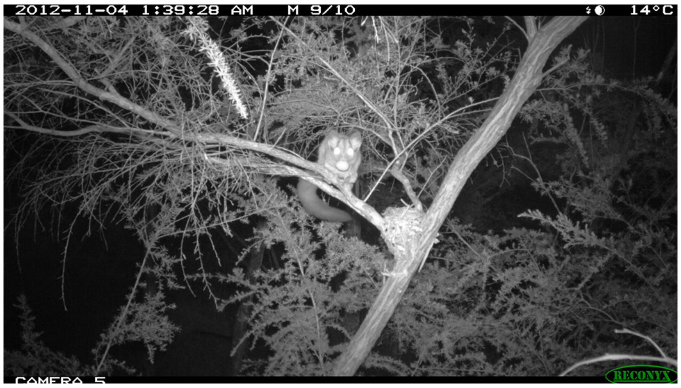

Plate 18. A Sugar Glider removes an egg from the nest of an Eastern Yellow Robin. The egg is clearly visible in the mouth.

Plate 19. A Superb Fairy-wren nest is in the centre of the field of view, hidden behind grass, behind the fork in the stick. The tail of an Eastern Whipbird can be seen exiting the field of view to the right.

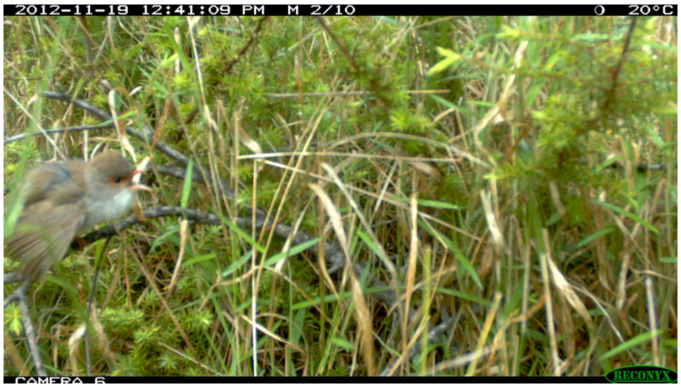

Plate 20. Twelve seconds later the female Superb Fairy-wren appears, threatening the departing Eastern Whipbird.

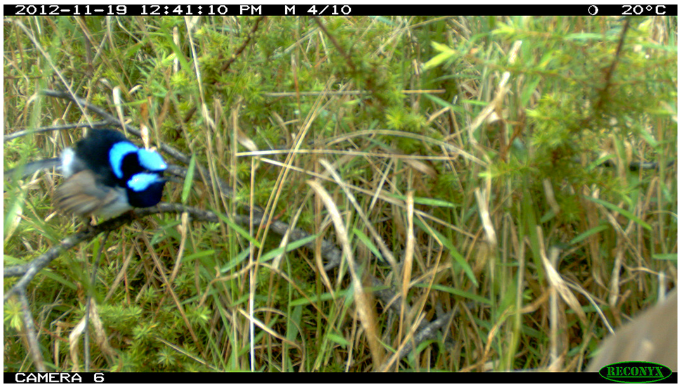

Plate 21. One second later the male Superb Fairy-wren appears on the same perch, again threatening in the direction of the departing Eastern Whipbird. The female fairy-wren has moved towards the Eastern Whipbird and can be seen as a blur in the bottom RH corner of the field of view.